# CHI MEI
### OPTOELECTRONICS CORP.

# TFT LCD Tentative Specification

# MODEL NO.: M156B3-L01

Customer: _____

Approved by: _____

Note:

| 記錄 | 工作 | 審核 | 角色 | 投票 |
|---|---|---|---|---|
| 2008-10-31 18:31:25 CST | PMMD II Director | kevin_wu(吳柏勳 /56520/54894) | Director | Accept |

**Version 0.0**

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**Version 0.0**

| | Date | Section | Description |
|---|---|---|---|
| 0.0 | Oct. 21, 08' | - | M156B3-L01 Specifications was first issued. |

**Version 0.0**

# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

M156B3-L01 is a 15.6" wide TFT Liquid Crystal Display module with white LED Backlight unit and 30 pins 1ch-LVDS interface. This module supports 1366 x 768 WXGA mode and can display 16.7M colors. The converter module for Backlight is not built in.

## 1.2 FEATURES

- Contrast ratio 500:1

- Response time 8ms.

- WXGA (1366 x 768 pixels) resolution.

- DE (Data Enable) only mode.

- LVDS (Low Voltage Differential Signaling) interface.

- RoHS compliance.

- White LED Backlight Unit

- Low power consumption

## 1.3 APPLICATION

- TFT LCD Monitor

## 1.4 GENERAL SPECIFICATI0NS

| Item | Specification | Unit | Note |
|---|---|---|---|
| Active Area | 344.232(H) × 193.536(V) (15.6" diagonal) | mm | (1) |
| Bezel Opening Area | 347.5(H)x196.8(V) | mm | |
| Driver Element | a-si TFT active matrix | - | - |
| Pixel Number | 1366 x R.G.B. x 768 | pixel | - |
| Pixel Pitch | 0.252 (H) x 0.252 (V) | mm | - |
| Pixel Arrangement | RGB vertical stripe | - | - |
| Display Colors | 16.7M | color | - |
| Color saturation | (62) %NTSC (typ.) | - | - |
| Surface Treatment | AG type, 3H hard coating, Haze 25 | - | - |

## 1.5 MECHANICAL SPECIFICATIONS

| Item | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| Module Size | Horizontal(H) | 363.3 | 363.8 | 364.3 | mm | (1) |
| | Vertical(V) | 215.4 | 215.9 | 216.4 | mm | |
| | Depth(D) | (10.4) | (10.9) | (11.6) | mm | |
| Weight | | - | | (1081) | g | - |

Note (1)  Please refer to the attached drawings for more information of front and back outline dimensions.

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## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item | Symbol | Value | | Unit | Note |
|------|--------|-------|-------|------|------|
| | | Min. | Max. | | |
| Storage Temperature | $T_{ST}$ | -20 | +60 | ºC | (1) |
| Operating Ambient Temperature | $T_{OP}$ | 0 | +50 | ºC | (1), (2) |
| Shock (Non-Operating) | $S_{NOP}$ | - | 50 | G | (3), (5) |
| Vibration (Non-Operating) | $V_{NOP}$ | - | 1.5 | G | (4), (5) |

Note (1)   Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta $\leqq$ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2)   The temperature of panel display surface area should be 0 ºC Min. and 60 ºC Max.
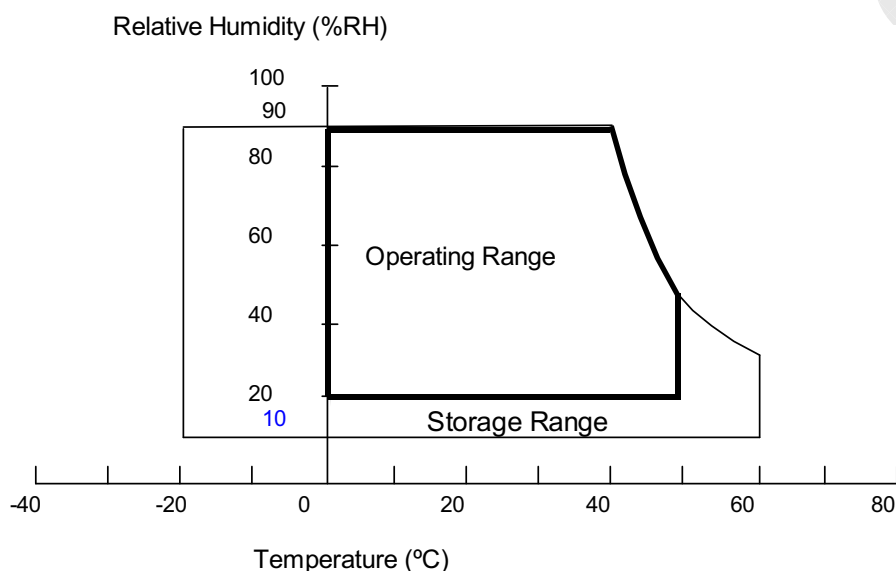


Note (3) 50G,11ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4)   10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z.

Note (5)   At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

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## 2.2 ELECTRICAL ABSOLUTE RATINGS

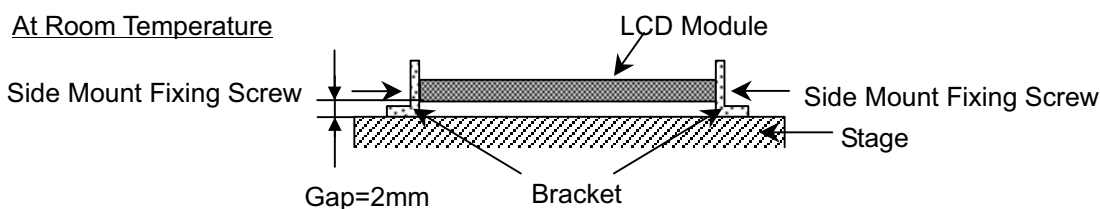### 2.2.1 TFT LCD MODULE

| Item | Symbol | Value | | Unit | Note |
| --- | --- | --- | --- | --- | --- |
| | | Min. | Max. | | |
| Power Supply Voltage | Vcc | -0.3 | +6.0 | V | (1) |

### 2.2.2 BACKLIGHT UNIT

| Item | Symbol | Value | | | Unit | Note |
| --- | --- | --- | --- | --- | --- | --- |
| | | Min. | Typ. | Max. | | |
| Converter Input Voltage | $V_{in}$ | 11.4 | 12.0 | 12.6 | V | (1), (2) |
| | $EN(V_{IH})$ | 3.0 | - | 5.0 | V | |
| | $EN(V_{IL})$ | 0 | - | 0.5 | | |
| Converter Dimming | $F_s$ | - | 200 | - | Hz | |
| | PWMIN ($V_{IH}$) | 3.0 | - | 5.0 | V | |
| | PWMIN ($V_{IL}$) | 0 | - | 0.5 | | |
| | Duty | 20 | - | 100 | % | |
| Converter Input Current | $I_{in}$ | - | - | 0.7 | A | |

Note (1)  Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2)  Specified values are for LED (Refer to 3.3 for further information).

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## 3. ELECTRICAL CHARACTERISTICS

### 3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Power Supply Voltage | | Vcc | 4.5 | 5.0 | 5.5 | V | - |
| Ripple Voltage | | $V_{RP}$ | - | - | 100 | mV | - |
| Rush Current | | $I_{RUSH}$ | - | (0.84) | 2 | A | (2) |
| Power Supply Current | White | - | - | (0.32) | - | A | (3)a |
| | Black | - | - | (0.38) | - | A | (3)b |
| | Vertical Stripe | - | - | (0.40) | - | A | (3)c |
| Power Consumption | | $P_{LCD}$ | - | (2.0) | - | watt | (4) |
| LVDS differential input voltage | | Vid | 100 | - | 600 | mV | |
| LVDS common input voltage | | Vic | - | 0.8 | - | V | |

Note (1)  The module should be always operated within above ranges.

Note (2)  Measurement Conditions:
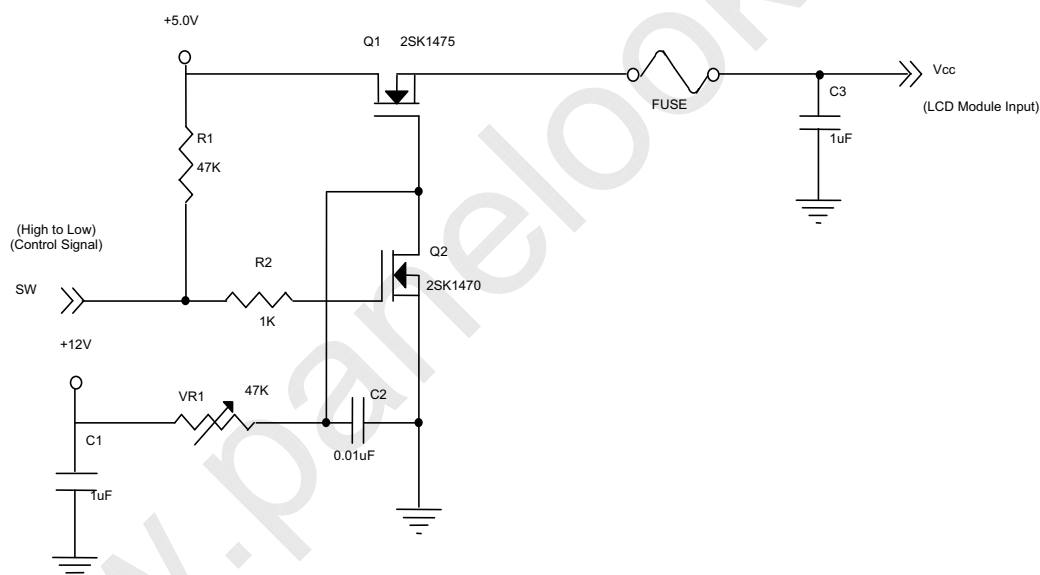


**Vcc rising time is 470μs**
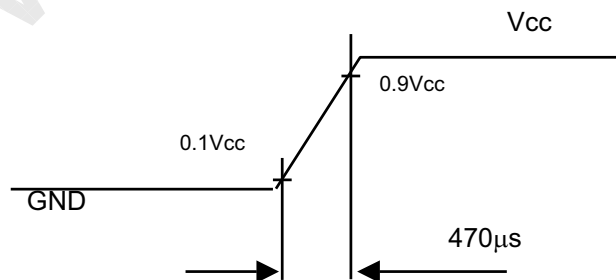
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Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 ºC, $f_v$ = 60 Hz, whereas a power dissipation check pattern below is displayed.

Note(4) The power consumption is specified at the pattern with the maximum current.

a. White Pattern
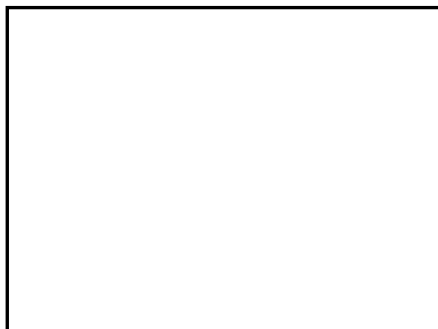
Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern
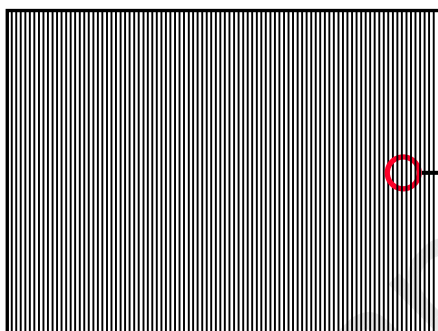
Active Area
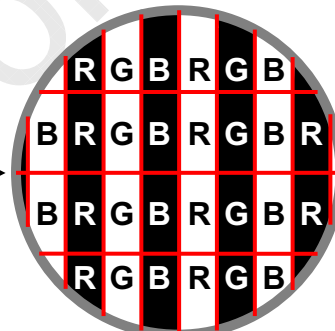
3.2 Vcc Power Dip Condition:

Vcc

4.5V

4.0V

Td
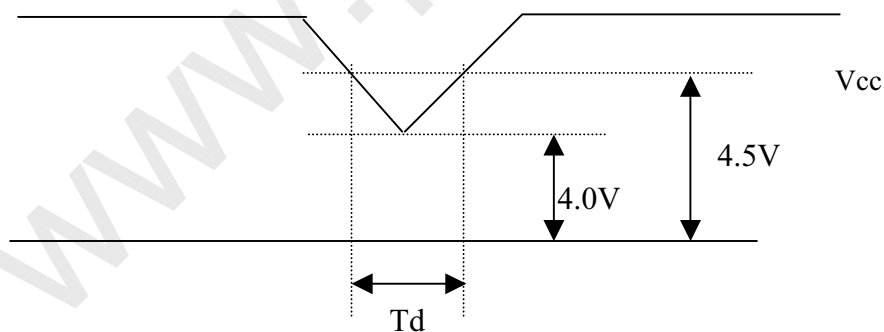
Dip condition: $4.0V \leq Vcc \leq 4.5V, Td \leq 20ms$

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## 3.3 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

| Parameter | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| LED light bar Input Voltage | $V_O$ | --- | 32 | (35) | $V_{DC}$ | (1), (Duty 100%) |
| LED light bar Lamp Current | $I_O$ | -- | 180 | -- | $mA_{DC}$ | (1), (Duty 100%) |
| LED Life Time | $L_{BL}$ | (20000) | --- | --- | Hrs | (2) |
| Power Consumption | $P_O$ | --- | 5.76 | --- | W | (3), $I_L$ = 180mA |

Note (1)  LED current is measured by utilizing a high frequency current meter as shown below:

Note (2)  The lifetime of LED is defined as the time when it continues to operate under the conditions at     Ta = 25 ±

2 oC and I = 40 mA(Per EA) until the brightness becomes ≦ 50% of its original value.

Note (3)  $P_O = I_O \times V_O$

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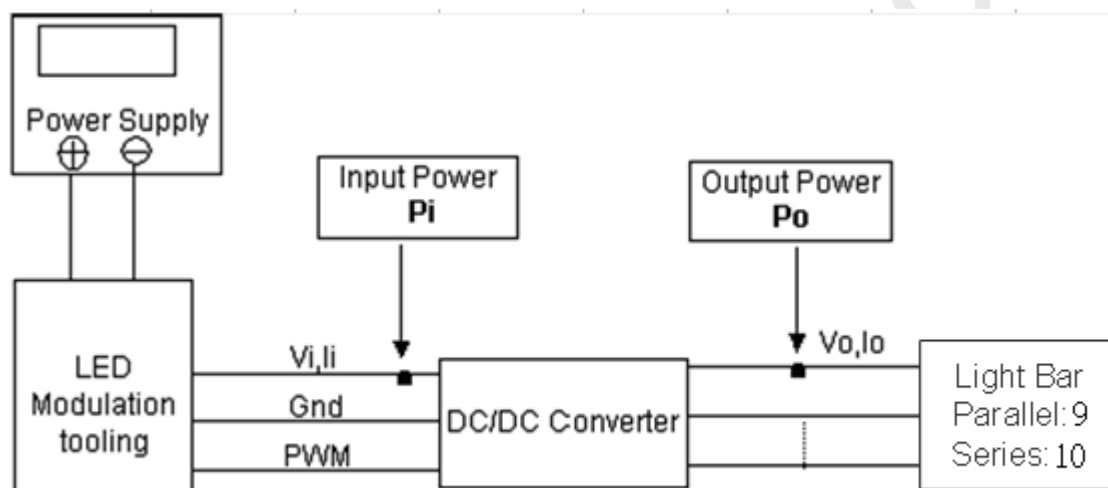
# 4. BLOCK DIAGRAM

## 4.1 TFT LCD MODULE

RXO0(+/-)
RXO1(+/-)
RXO2(+/-)
RXO3(+/-)
RXOC(+/-)
RXE0(+/-)
RXE1(+/-)
RXE2(+/-)
RXE3(+/-)
RXEC(+/-)
NC
Vcc
GND

**INPUT CONNECTOR
(STARCONN 093G30-B2001A
or EQUIVALENT)**

**LVDS INPUT /
TIMING CONTROLLER**

**DC/DC CONVERTER &
REFERENCE VOLTAGE**

**SCAN DRIVER IC**

**TFT LCD PANEL
(1366x3x768)**

**DATA DRIVER IC**

V$_{IN}$
GND
PWMIN
EN

**input
(Aces 91208)**  **CONVERTER**  **output
(Aces 91500)**

V$_{LED}$

**BACKLIGHT UNIT**

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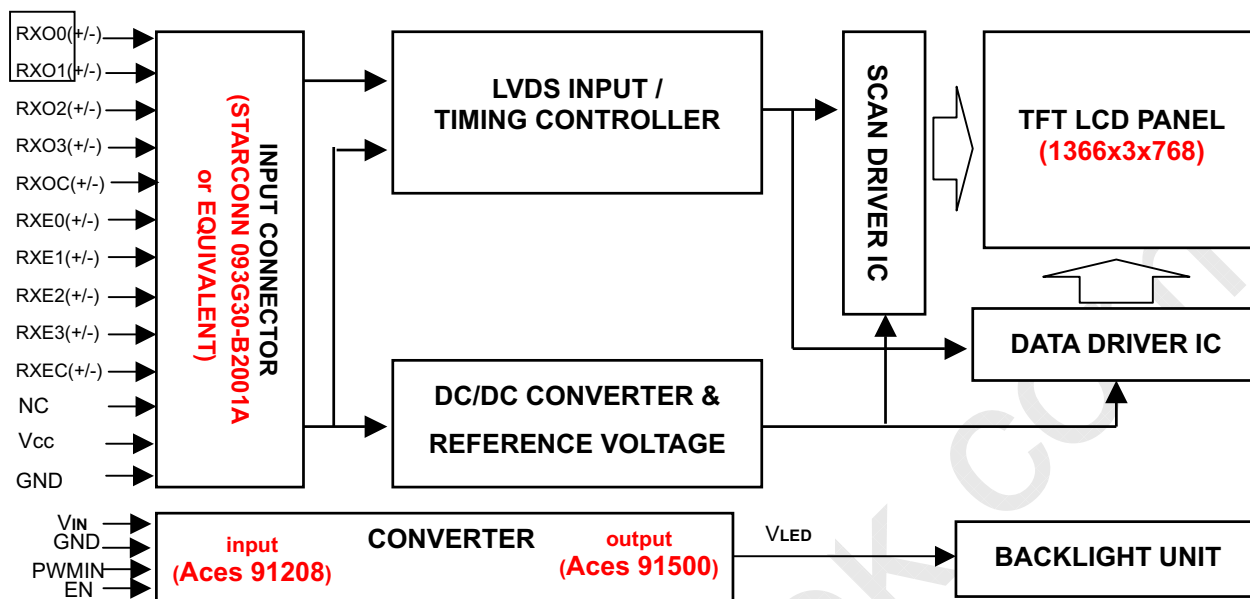
## 5. INPUT TERMINAL PIN ASSIGNMENT

### 5.1 TFT LCD MODULE

| Pin | Name | Description |
|-----|------|-------------|
| 1 | NC | Not connection, this pin should be open. |
| 2 | NC | Not connection, this pin should be open. |
| 3 | NC | Not connection, this pin should be open. |
| 4 | GND | Ground |
| 5 | RX0- | Negative LVDS differential data input. Channel 0 |
| 6 | RX0+ | Positive LVDS differential data input. Channel 0 |
| 7 | GND | Ground |
| 8 | RX1- | Negative LVDS differential data input. Channel 1 |
| 9 | RX1+ | Positive LVDS differential data input. Channel 1 |
| 10 | GND | Ground |
| 11 | RX2- | Negative LVDS differential data input. Channel 2 |
| 12 | RX2+ | Positive LVDS differential data input. Channel 2 |
| 13 | GND | Ground |
| 14 | RXCLK- | Negative LVDS differential clock input. |
| 15 | RXCLK+ | Positive LVDS differential clock input. |
| 16 | GND | Ground |
| 17 | RX3- | Negative LVDS differential data input. Channel 3 |
| 18 | RX3+ | Positive LVDS differential data input. Channel 3 |
| 19 | GND | Ground |
| 20 | NC | Not connection, this pin should be open. |
| 21 | NC | Not connection, this pin should be open. |
| 22 | AGMODE | AGMODE should be tied to ground or open. |
| 23 | GND | Ground |
| 24 | GND | Ground |
| 25 | GND | Ground |
| 26 | Vcc | +5.0V power supply |
| 27 | Vcc | +5.0V power supply |
| 28 | Vcc | +5.0V power supply |
| 29 | Vcc | +5.0V power supply |
| 30 | Vcc | +5.0V power supply |

Note (1) Connector Part No.: 093G30-B2001A (STARCONN)

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### 5.2 LVDS DATA MAPPING TABLE

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LVDS Channel 0 | LVDS output | D7 | D6 | D4 | D3 | D2 | D1 | D0 |
| | Data order | G0 | R5 | R4 | R3 | R2 | R1 | R0 |
| LVDS Channel 1 | LVDS output | D18 | D15 | D14 | D13 | D12 | D9 | D8 |
| | Data order | B1 | B0 | G5 | G4 | G3 | G2 | G1 |
| LVDS Channel 2 | LVDS output | D26 | D25 | D24 | D22 | D21 | D20 | D19 |
| | Data order | DE | NA | NA | B5 | B4 | B3 | B2 |
| LVDS Channel 3 | LVDS output | D23 | D17 | D16 | D11 | D10 | D5 | D27 |
| | Data order | NA | B7 | B6 | G7 | G6 | R7 | R6 |

## 5.3 CONVERTER SPECIFICATION

### 5.3.1 Connector type

Input connector type: 91208-01001 宏致(Aces)

Output connector: 91500-00801 宏致(Aces)

### 5.3.2 Input connector pin assignment

Input Connector pin assignment:

| Input connector | | Comments |
|---|---|---|
| (vendor) 宏致(Aces) | (type) 91208-01001 | |
| Pin | Function | |
| 1 | $V_{in}$ | Input voltage Power Supply + (12V.typ) |
| 2 | $V_{in}$ | Input voltage Power Supply + (12V.typ) |
| 3 | $V_{in}$ | Input voltage Power Supply + (12V.typ) |
| 4 | $V_{in}$ | Input voltage Power Supply + (12V.typ) |
| 5 | GND | Ground |
| 6 | GND | Ground |
| 7 | GND | Ground |
| 8 | GND | Ground |
| 9 | PWMIN | Brightness control (PWM signal input, 200Hz.Typ) |
| 10 | EN | Enable signal |

Note: Light on condition is that Vin, PWMIN and EN are all pulled high level together.

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## 5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color.

The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color | | Data Signal | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | R7 | R6 | G5 | G4 | G3 | G2 | G1 | G0 | R7 | R6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale Of Red | Red(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Green | Green(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale Of Blue | Blue(0) / Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1)  0: Low Level Voltage, 1: High Level Voltage

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## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|------|--------|------|------|------|------|------|
| LVDS Clock | Frequency | Fc | 50 | 76 | 96 | MHz | - |
| | Period | Tc | | 13 | | ns | |
| | High Time | Tch | - | 4/7 | - | Tc | - |
| | Low Time | Tcl | - | 3/7 | - | Tc | - |
| LVDS Data | Setup Time | Tlvs | 600 | - | - | ps | - |
| | Hold Time | Tlvh | 600 | - | - | ps | - |
| Vertical Active Display Term | Frame Rate | Fr | 40 | 60 | 76 | Hz | Tv=Tvd+Tvb |
| | Total | Tv | 778 | 806 | 888 | Th | - |
| | Display | Tvd | 768 | 768 | 768 | Th | - |
| | Blank | Tvb | Tv-Tvd | 38 | Tv-Tvd | Th | - |
| Horizontal Active Display Term | Total | Th | 1446 | 1560 | 1936 | Tc | Th=Thd+Thb |
| | Display | Thd | 1366 | 1366 | 1366 | Tc | - |
| | Blank | Thb | Th-Thd | 194 | Th-Thd | Tc | - |

Note:    Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic

level or ground. Otherwise, this module would operate abnormally.

## INPUT SIGNAL TIMING DIAGRAM

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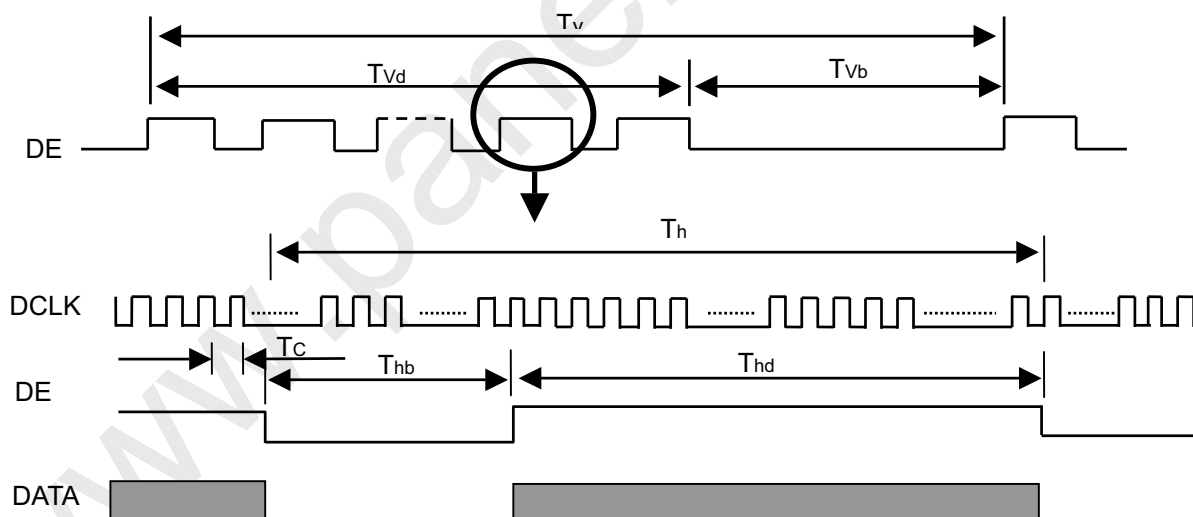
6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.
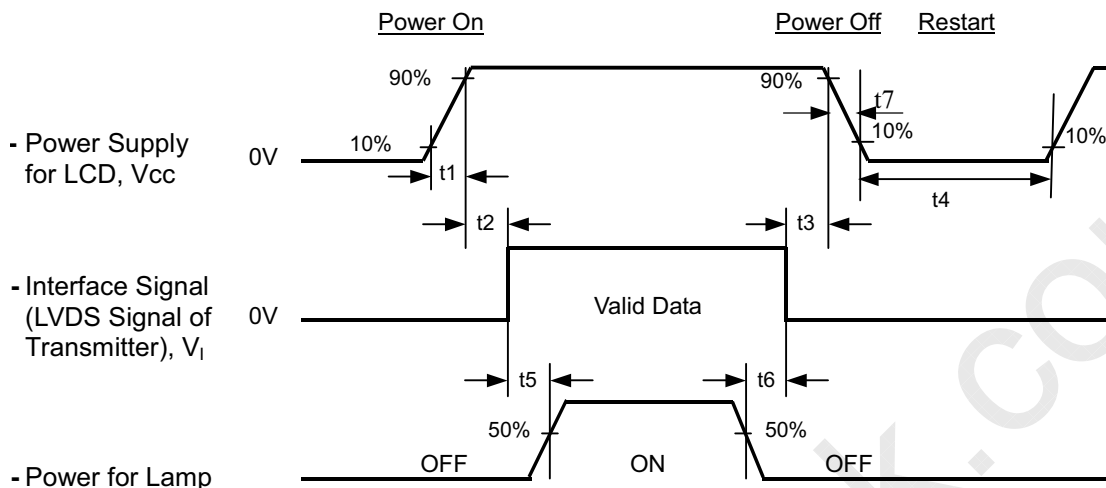


Timing Specifications:

$0.5 < t1 \leqq 10$ msec

$0 < t2 \leqq 50$ msec

$0 < t3 \leqq 50$ msec

$t4 \geqq 500$ msec

$t5 \geqq 450$ msec

$t6 \geqq 90$ msec

$5 \leqq t7 \leqq 100$ msec

Note.

(1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

(2) Apply the light bar voltage within the LCD operation range. When the backlight turns on before the LCD operation of the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

(3) In case of Vcc = off level, please keep the level of input signals on the low or keep a high impedance.

(4) t4 should be measured after the module has been fully discharged between power of and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

(6) The company will not guarantee or compensate for the product damage caused by not following the Power Sequence.

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# 7. OPTICAL CHARACTERISTICS

## 7.1 TEST CONDITIONS

| Item | Symbol | Value | Unit |
|---|---|---|---|
| Ambient Temperature | Ta | 25±2 | °C |
| Ambient Humidity | Ha | 50±10 | %RH |
| Supply Voltage | $V_{CC}$ | 5.0 | V |
| Input Signal | According to typical value in "3. ELECTRICAL CHARACTERISTICS" | | |
| LED Light Bar Input Current | $I_L$ | 180 | mA |

## 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Color Chromaticity | Red | Rx | $\theta_x=0°, \theta_Y=0°$ CS-1000T | -0.05 | (0.635) | +0.05 | | (1), (5) |
| | | Ry | | | (0.346) | | | |
| | Green | Gx | | | (0.324) | | | |
| | | Gy | | | (0.616) | | | |
| | Blue | Bx | | | (0.157) | | | |
| | | By | | | (0.064) | | | |
| | White | Wx | | | (0.313) | | | |
| | | Wy | | | (0.329) | | | |
| Center Luminance of White | | $L_C$ | | (230) | (300) | --- | cd/m$^2$ | (4), (5) |
| Contrast Ratio | | CR | | 350 | 500 | --- | - | (2), (5) |
| Response Time | | $T_R$ | $\theta_x=0°, \theta_Y=0°$ | --- | 2 | 4 | ms | (3) |
| | | $T_F$ | | --- | 6 | 12 | ms | |
| White Variation | | δW | $\theta_x=0°, \theta_Y=0°$ | --- | --- | 1.33 | - | (5),13 點(離邊 1/10) |
| Viewing Angle | Horizontal | $\theta_x+$ | CR ≧ 10 | 40 | 45 | --- | Deg. | (1), (5) |
| | | $\theta_x-$ | | 40 | 45 | --- | | |
| | Vertical | $\theta_Y+$ | | 15 | 20 | --- | | |
| | | $\theta_Y-$ | | 40 | 45 | --- | | |

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**Tentative**

Note (1)    Definition of Viewing Angle (θx, θy):

Normal

θx = θy = 0º

θy-    θy+

θx- = 90º    x-

θx–    y+

12 o'clock direction

θx+    θy+ = 90º

6 o'clock    y-

θy- = 90º    x+    θx+ = 90º
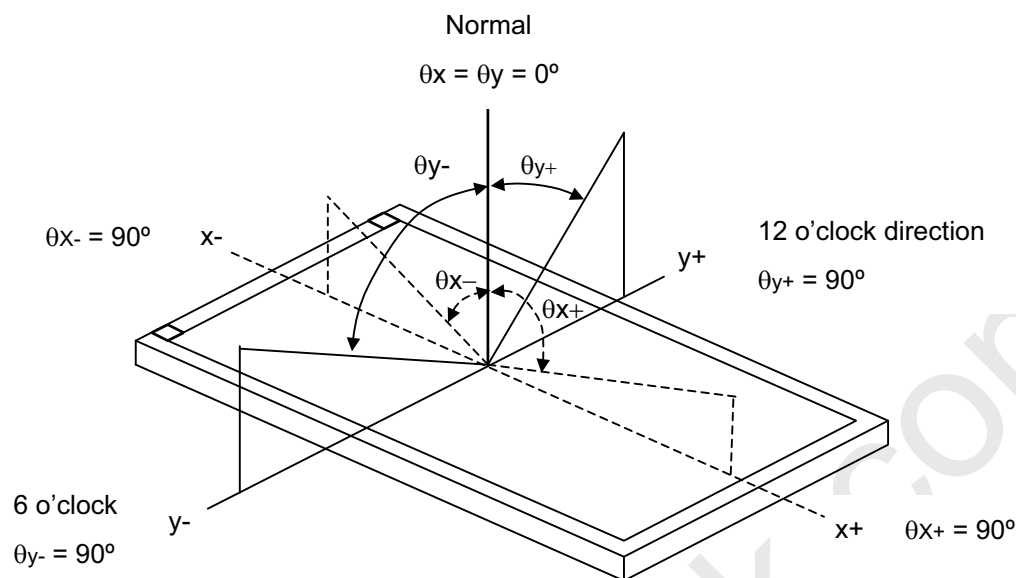
Note (2)   Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

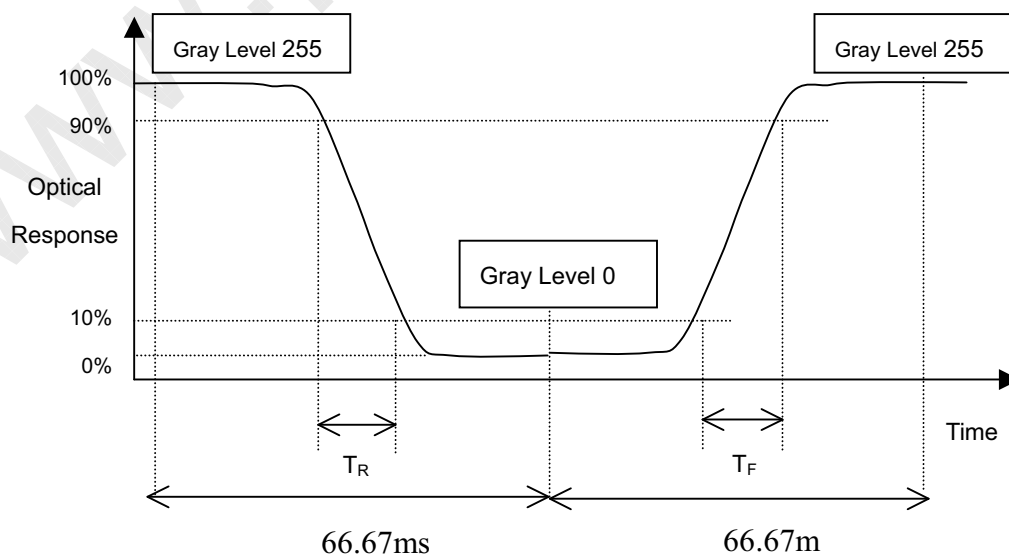L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3)   Definition of Response Time ($T_R$, $T_F$):

Gray Level 255    Gray Level 255

100%

90%

Optical

Response

Gray Level 0

10%

0%

Time

$T_R$    $T_F$

66.67ms    66.67m

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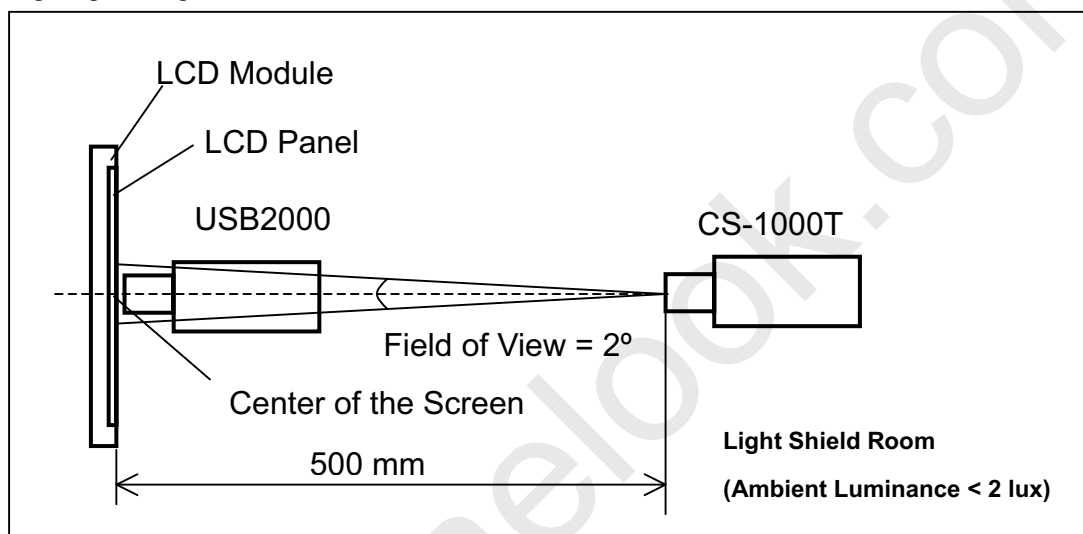
Note (4)   Definition of Luminance of White ($L_C$):

Measure the luminance of gray level 255 at center point

$L_C = L(1)$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6).
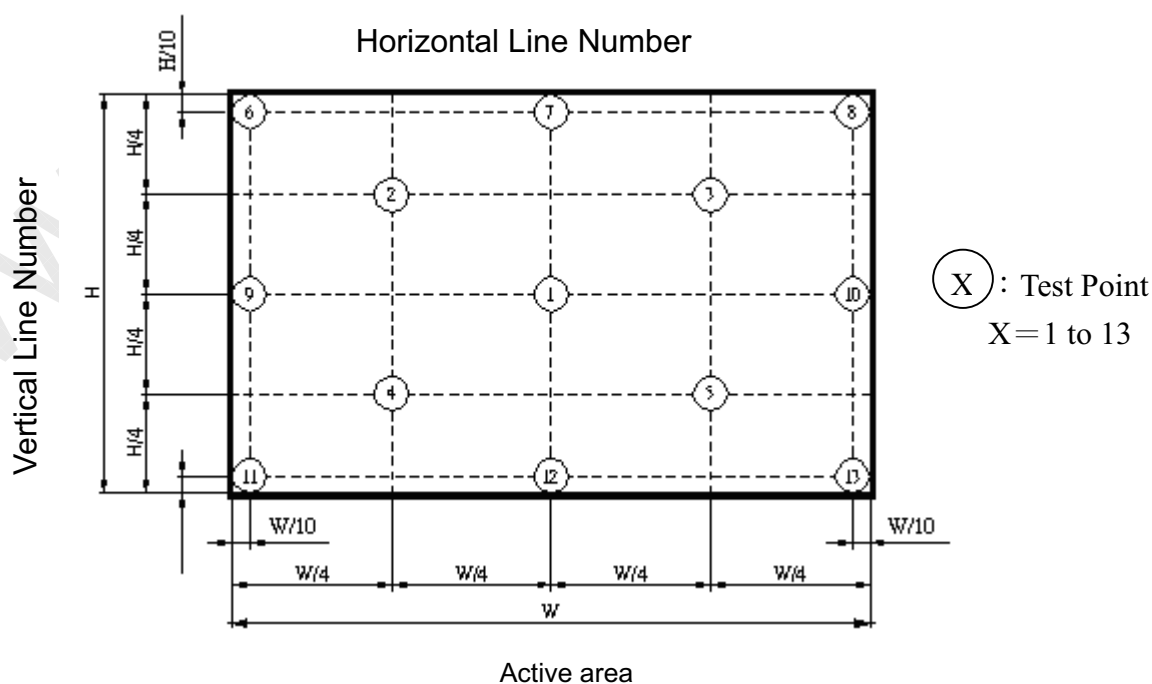
Note (5)   Measurement Setup:

The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.

LCD Module

LCD Panel

USB2000                                     CS-1000T

Field of View = 2º

Center of the Screen

500 mm

**Light Shield Room**

**(Ambient Luminance < 2 lux)**

Note (6)   Definition of White Variation (δW):

Measure the luminance of gray level 255 at 13 points

δW = Maximum [L (1), L (2) ……L (4), L (13)] / Minimum [L (1), L (2) …… L (4), L (13)]

Horizontal Line Number

H/10

H/4

H/4

Vertical Line Number

H

H/4

H/4

6      7      8

2      3

9      1      10

4      5

11     12     13

W/10                                W/10

W/4     W/4     W/4     W/4

W

X : Test Point

X＝1 to 13

Active area

18 / 24

**Version 0.0**

## 8. PACKAGING

### 8.1 PACKING SPECIFICATIONS

(1) 12 LCD modules / 1 Box

(2) Box dimensions: 490(L) X 325(W) X 320(H) mm

(3) Weight: approximately 15.7Kg (12 modules per box)

### 8.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items.

| Test Item | Test Conditions | Note |
|---|---|---|
| Vibration | ISTA STANDARD<br>Random, Frequency Range: 1 – 200 Hz<br>Top & Bottom: 30 minutes (+Z), 10 min (-Z),<br>Right & Left: 10 minutes (X)<br>Back & Forth 10 minutes (Y) | Non Operation |
| Dropping Test | 1 Corner, 3 Edge, 6 Face, ISTA STANDARD | Non Operation |



Box Dimensions: 490(L)*325(W)*320(H) mm
Weight: Approx. 15.7 kg (12 module .per. 1box)
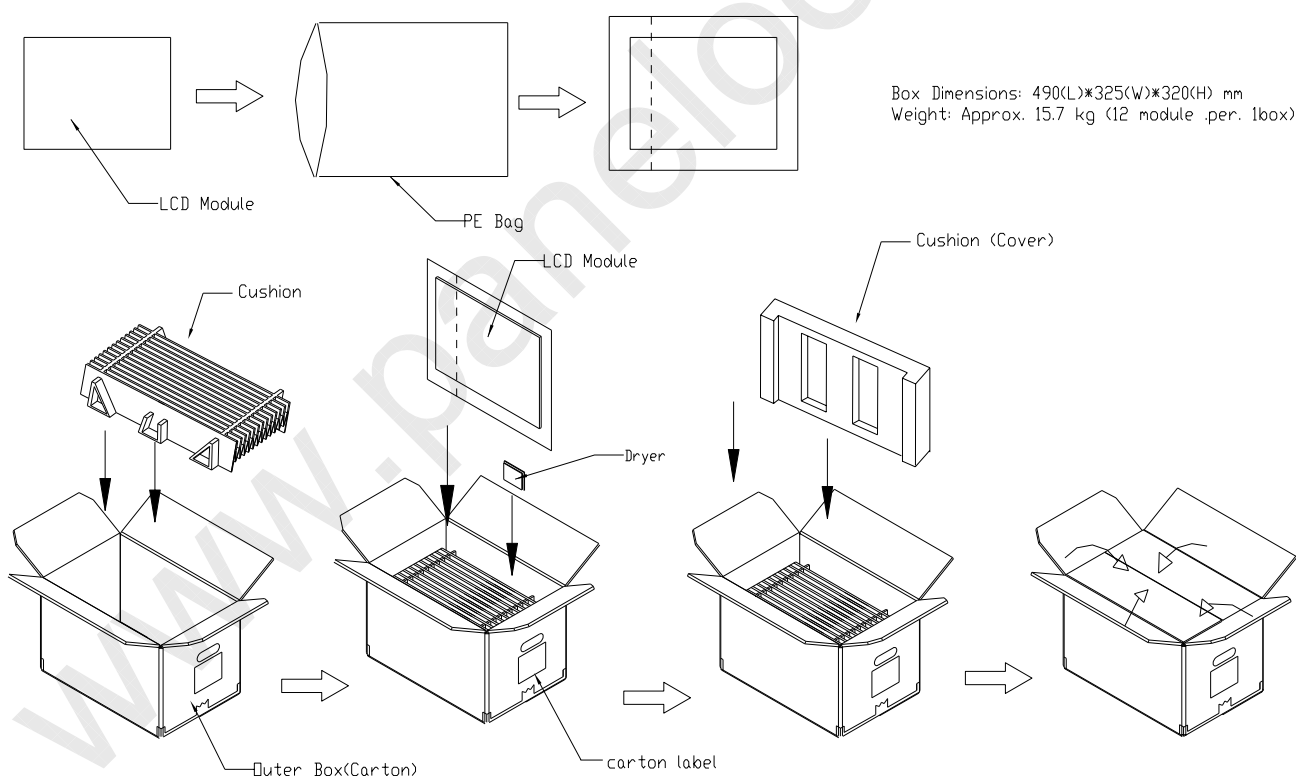
**Figure. 8-1 Packing method**

**Version 0.0**

For ocean shipping

Sea / Land Transportation (40ft Container)
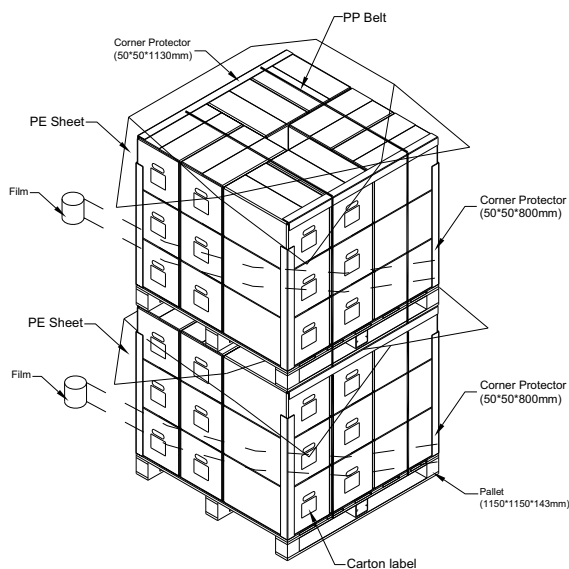


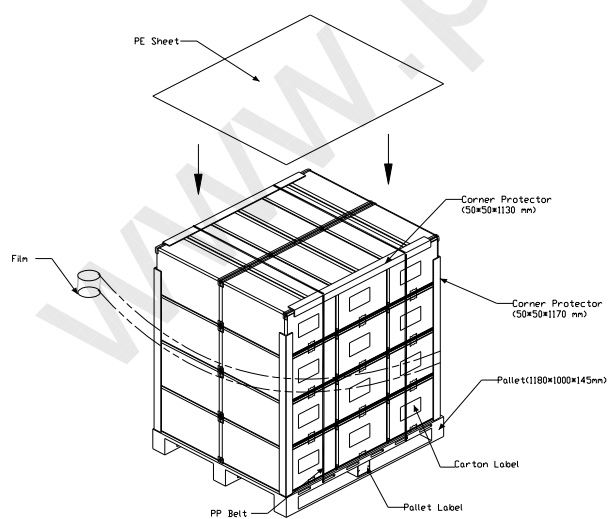**Figure. 8-2 Packing method**

For air transport

Air transportation



**Figure. 8-3 Packing method**

**Version 0.0**

**Tentative**

# 9. DEFINITION OF LABELS

## 9.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: M156B3-L01

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

| Code | Meaning | Description |
|------|---------|-------------|
| XX | CMO internal use | - |
| XX | Revision | Cover all the change |
| X | CMO internal use | - |
| YMD | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4…<br>Month: 1~12=1, 2, 3, ~, 9, A, B, C<br>Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U. |
| L | Product line # | Line 1=1, Line 2=2, Line 3=3, … |
| NNNN | Serial number | Manufacturing sequence of product |

(d) Customer's barcode definition:

Serial ID: CM-15B31-X-X-X-XX-L-XX-L-YMD-NNNN

| Code | Meaning | Description |
|------|---------|-------------|
| CM | Supplier code | CMO=CM |
| 15B31 | Model number | M156B3-L01=15B31 |
| X | Revision code | Non ZBD: 1,2,~,8,9 / ZBD: A~Z |
| X | Source driver IC code | Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M |
| X | Gate driver IC code | |
| XX | Cell location | Tainan, Taiwan=TN |
| L | Cell line # | 1,2,~,9,A,B,~,Y,Z |
| XX | Module location | Tainan, Taiwan=TN ; Ningbo China=NP |
| L | Module line # | 1,2,~,9,A,B,~,Y,Z |
| YMD | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4…<br>Month: 1~12=1, 2, 3, ~, 9, A, B, C<br>Day: 1~31= 1, 2, 3, ~, 9, A, B, C, ~, T, U, V |
| NNNN | Serial number | Manufacturing sequence of product |

**Version 0.0**

(e) UL Factory ID:

| Region | Factory ID |
|--------|-----------|
| TWCMO | GEMN |
| NBCMO | LEOO |
| NBCME | CANO |
| NHCMO | CAPG |

## 10. PRECAUTIONS

### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS
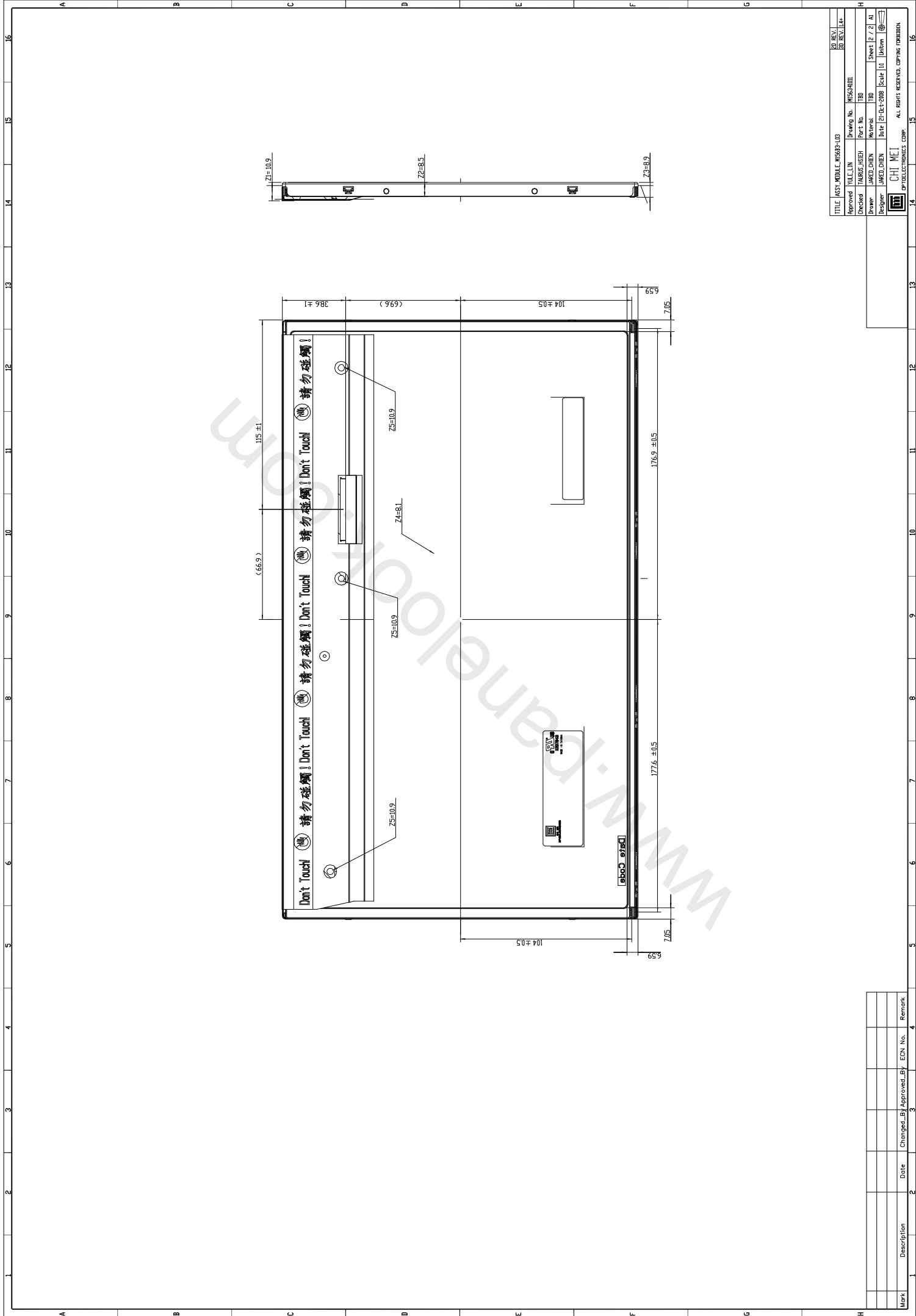
(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

(5) Do not pull the I/F connector in or out while the module is operating.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(10) When ambient temperature is lower than 10ºC may reduce the display quality.

### 10.2 SAFETY PRECAUTIONS

(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.

### 10.3 OTHER

When fixed patterns are displayed for a long time , remnant image is likely to occur.

**Version 0.0**

Active Area 344.232X193.536

NOTES:
1.OUTLINE TOLERANCE: ±0.5mm.
2."*" MARKS THE DESIGN CRITICAL DIMENSION.
3." Ⓟ " MARKS THE PROCESS CRITICAL DIMENSION.
4.MAX.SCREW LENGTH=4 mm.
5.MAX.SCREW TORQUE=5 kg-cm.

SECTION A-A

(MAX.GAP 0.5mm)

4-M3 USER HOLES
MAX. SCREW LENGTH=4.2mm

| TITLE | ASSY.MODULE.M156B3-L01 | | | | PD REV. | |
|---|---|---|---|---|---|---|
| | | | | | BD REV. | L4+ |
| Approved | YULK_LIN | Drawing No. | M156240001 | | | |
| Checked | TAURUS_HSIEH | Part No. | TBD | | | |
| Drawer | JARED_CHIEN | Material | TBD | Sheet | 1 / 2 | A1 |
| Designer | JARED_CHIEN | Date | 21-Oct-2008 | Scale | TBD | Uniform | 1:1 |
| CHI MEI | | | | | | |
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| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
|---|---|---|---|---|---|---|

| TITLE | ASS'Y_MODULE_M156B3-L03 | | PD REV. | |
|---|---|---|---|---|
| | | | BD REV. | LA+ |
| Approved | YULE_LIN | Drawing No. | M156B34001 | |
| Checked | TAURUS_HSIEH | Part No. | TBD | |
| Drawer | JARED_CHEN | Material | TBD | Sheet 2 / 2 A1 |
| Designer | JARED_CHEN | Date 21-Oct-2008 | Scale 1:1 | Uniform mm |

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| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |
|---|---|---|---|---|---|---|

Z1=10.9    Z2=8.5    Z3=8.9

Z5=10.9    Z4=8.1    Z5=10.9    Z5=10.9

386 ±1    (696)    104 ±0.5    6.59    7.05

115 ±1    (66.9)    176.9 ±0.5    177.6 ±0.5

104 ±0.5    7.05    6.59

Don't Touch!  請勿碰觸! Don't Touch!  請勿碰觸! Don't Touch!  請勿碰觸! Don't Touch!  請勿碰觸!

CMO